

collection container, and the exterior of the package cannot be cleaned of contaminating matter that accumulates during sampling. Further, the swab must again be retrieved from the package. Thus while the sample is protected, the user is potentially exposed at multiple levels.

[0017] Miniaturizing some of the processes involved in clinical analyses, including nucleic acid, immunological and enzymatic analysis, or combinations thereof, has been achieved using microfluidic devices. Microfluidic techniques known in the art include electrophoretic detectors, for example those designed by ACLARA BioSciences Inc., or the LabChip™ by Caliper Technologies Inc, and hybridization detectors such as those manufactured by Nanogen of San Diego. Also indicative of the state of the art are PCT Publication WO1994/05414, U.S. Pat. Nos. 5,498,392, 5,304,487, 5,296,375, 5,856,174, 6,180,372, 5,939,312, 5,939,291, 5,863,502, 6,054,277, 6,261,431, 6,440,725, 5,587,128, 5,955,029, 5,498,392, 5,639,423, 5,786,182, 6,261,431, 6,126,804, 5,958,349, 6,303,343, 6,403,037, 6,429,007, 6,420,143, 6,572,830, 6,541,274, 6,544,734, 6,960,437, 6,762,049, 6,509,186, 6,432,695, 7,018,830, and 2001/0046701, 2003/0138941, and International Pat. Nos. WO 2003/004162, WO2002/18823, WO2001/041931, WO1998/50147, WO1997/27324, all of which describe apparatuses and methods incorporating various microfluidic processing and analytical operations involved in nucleic acid analysis, and are incorporated herein by reference.

[0018] Co-assigned to Micronics, Inc of Redmond Wash., and also incorporated herein in full by reference, are U.S. Pat. No. 6,743,399 ("Pumpless Microfluidics"), U.S. Pat. No. 6,488,896 ("Microfluidic Analysis Cartridge"), U.S. Pat. No. 5,726,404 ("Valveless Liquid Microswitch"), U.S. Pat. No. 5,932,100 ("Microfabricated Differential Extraction Device and Method"), ("Tangential Flow Planar Microfluidic Fluid Filter"), U.S. Pat. No. 5,872,710 ("Microfabricated Diffusion-Based Chemical Sensor"), U.S. Pat. No. 5,971,158 ("Absorption-Enhancing Differential Extraction Device"), U.S. Pat. No. 6,007,775 ("Multiple Analyte Diffusion-Based Chemical Sensor"), U.S. Pat. No. 6,581,899 ("Valve for Use in Microfluidic Structures"), U.S. Pat. No. 6,431,212 ("Valve for Use in Microfluidic Structures"), U.S. Pat. No. 7,223,371 ("Microfluidic Channel Network Device"), U.S. Pat. No. 6,541,213 ("Microscale Diffusion Immunoassay"), U.S. Pat. No. 7,226,562 ("Liquid Analysis Cartridge"), U.S. Pat. No. 5,747,349 ("Fluorescent Reporter Beads for Fluid Analysis"), US Patent Applications 2005/0106066 ("Microfluidic Devices for Fluid Manipulation and Analysis"), 2002/0160518 ("Microfluidic Sedimentation"), 2003/0124619 ("Microscale Diffusion Immunoassay"), 2003/0175990 ("Microfluidic Channel Network Device"), 2005/0013732 ("Method and system for Microfluidic Manipulation, Amplification and Analysis of Fluids"), 2007/0042427, "Microfluidic Laminar Flow Detection Strip", 2005/0129582 (System and Method for Heating, Cooling and Heat Cycling on a Microfluidic Device); and unpublished US Patent documents titled, "Integrated Nucleic Acid Assays," "Microfluidic Cell Capture and Mixing Circuit", "Microfluidic Mixing and Analytical Apparatus," "System and Method for Diagnosis of Infectious Diseases", "Methods and Devices for Microfluidic Point of Care Assays", "Integrated Microfluidic Assay Devices and Methods", and "Microscale Diffusion Immunoassay Utilizing Multivalent Reactants", all of which are hereby incorporated in full by reference. Also representative of microfluidic technologies that are co-assigned to Micron-

ics are PCT Publications WO 2006/076567 and 2007/064635, all incorporated herein in full by reference for what they enable.

[0019] The utility and breadth of microfluidic assays for nucleic acid assays is further demonstrated in the scientific literature, the teachings of which are incorporated by reference herein. These teachings include, for example, Nakano H et al. 1994. High speed polymerase chain reaction in constant flow. *Biosci Biotechnol Biochem* 58:349-52; Wilding, P et al. 1994. PCR in a silicon microstructure. *Clin Chem* 40(9): 1815-18; Woolley A T et al. 1996. Functional integration of PCR amplification and capillary electrophoresis in a micro-fabricated DNA analysis device. *Anal Chem* 68:4081-86; Burke D T et al. 1997. Microfabrication technologies for integrated nucleic acid analysis. *Genome Res* 7:189-197; Kopp et al. 1998. Chemical amplification: continuous-flow PCR on a chip. *Science* 280:1046-48; Burns, M.A. 1998. An Integrated Nanoliter DNA Analysis Device. *Science* 282: 484-87; Belgrader P et al. 1999. PCR Detection of bacteria in seven minutes. *Science* 284:449-50; Lagally E T et al. 2001. Fully integrated PCR-capillary electrophoresis microsystem for DNA analysis. *Lab Chip* 1:102-07; Tudos A J et al. 2001. Trends in miniaturized total analysis systems for point-of-care testing in clinical chemistry. *Lab Chip* 1:83-95; Belgrader P et al. 2002. A battery-powered notebook thermocycler for rapid multiplex real-time PCR analysis. *Anal Chem* 73:286-89; Hupert L M et al. 2003. Polymer-Based Microfluidic Devices for Biomedical Applications. In, (H Becker and P Woias, eds) *Microfluidics, BioMEMS, and Medical Microsystems*, Proc SPIE Vol 4982:52-64; Chartier I et al. 2003. Fabrication of an hybrid plastic-silicon microfluidic device for high-throughput genotyping. In, (H Becker and P Woias, eds) *Microfluidics, BioMEMS, and Medical Microsystems*, Proc SPIE Vol 4982:208-219; Anderson R C et al. 2000. A miniature integrated device for automated multiplex genetic assays. *Nucl Acids Res* 28(12):[e60,i-vi]; Yang, J et al. 2002. High sensitivity PCR assay in plastic micro reactors. *Lab Chip* 2:179-87; Giordano B C et al. 2001. Polymerase chain reaction in polymeric microchips: DNA amplification in less than 240 sec. *Anal Biochem* 291:124-132; Khandurina J et al. 2000. Integrated system for rapid PCR-based DNA analysis in microfluidic devices. *Anal Chem* 72:2995-3000; Chiou, J et al. 2001. A Closed-Cycle Capillary Polymerase Chain Reaction Machine. *Anal Chem* 73:2018-21; Yuen, P K et al. 2001. Microchip module for blood sample preparation and nucleic acid amplification reactions. *Genome Res* 11:405-412; Zhou X, et al. 2004. Determination of SARS-coronavirus by a microfluidic chip system. *Electrophoresis*. 25(17):3032-9; Liu Y et al. 2002. DNA amplification and hybridization assays in integrated plastic monolithic devices. *Anal Chem* 74(13):3063-70; Zou, Q et al. 2002. Micro-assembled multi-chamber thermal cycler for low-cost reaction chip thermal multiplexing. *Sensors Actuators A* 102:224-121; Zhang C et al. 2006. PCR Microfluidic devices for DNA amplification. *Biotech Adv* 24:243-84, and Zhang, C and Xing D. 2007. Miniaturized PCR chips for nucleic acid amplification and analysis: latest advances and future trends. *Nucl Acids Res* 35(13):4223-37.

[0020] Thus there is a clear and ongoing interest in microfluidic devices for clinical and veterinary diagnostic assays. As these commercial applications increase, the world-to-chip interface is receiving increasing attention, and we note that little has been done in the area of sample collection to both improve the validity of nucleic acid amplifications by pre-